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Impacts of Flood on Bedform-driven Hyporheic Flux under Gaining and Losing Groundwater Conditions

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Hyporheic Zone response to dynamic hydrologic forcing has recently attracted increasing attentions. Understanding transient bedform-driven hyporheic processes requires comprehensive investigation on the interplay of time-varying hydraulic forces, streambed topography, channel geomorphology and ambient groundwater conditions. The aim of the present study is to systematically explore the bedform induced hyporheic responses to flood events with two different intensities, three different bedform topographies, four channel slopes and ten groundwater up/downwelling conditions. The spatial extent of Hporheic Zone, the intensity of Hyporheic Exchange Fluxes, the flux-weighted residence time distribution, and the hyporheic efficiency to denitrification process are used to assess the impacts of flood events. We find that flood events alter the subsurface flow paths and velocities and enlarge the Hyporheic Zone Extent; however, comparing both the Hyporheic Zone Extent and Hyporheic Exchange Fluxes across 3 aspect ratios, increasing flood intensity cannot enhance Hyporheic Zone Extent and Hyporheic Exchange Fluxes the same extent as increasing aspect ratios. Our model additionally shows that the extends which flood events lower the hyporheic efficiency depend highly on the groundwater upwelling velocities and bedform topography.